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MADROÑO

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NOTES ON MALVACEAE. VIII. EREMALCHE

Thomas H. Kearney

The genus *Eremalche* was published by Greene (1906, p. 208) with a few words of description and citation of three species previously referred to *Malvastrum* — *M. rotundifolium* A. Gray, *M. exile* A. Gray, and *M. Parryi* Greene. A fourth species, *Eremalche kernensis* C. B. Wolf (1938, pp. 66, 67), was published subsequently. Jepson (1925, p. 633 and 1936, pp. 496, 497) referred the three species cited by Greene to *Sphaeralcea*, but they have been retained in *Malvastrum* in other recent floras (Munz, 1935, p. 308; Kearney et al., 1951, p. 548). It remained for Wiggins (1951, pp. 96, 97) to recognize *Eremalche* as a valid genus and to describe it formally, with a key to and descriptions of the four species.

In my synopsis of the American genera of Malvaceae (Kearney, 1951, pp. 119, 120), *Eremalche* was treated as a section of *Malvastrum*. Now, however, I find myself in agreement with Wiggins as to its validity as a genus. Krapovickas (1954, pp. 609, 610) had arrived at the same conclusion, pointing out that in *Eremalche exilis* the diploid number of chromosomes is 20, hence a multiple of 5, as was found to be the case in *Sphaeralcea* (*Eusphaeralcea*) by Webber (1936, pp. 314, 315) in fifteen North American species and by Krapovickas (1949, p. 185) in thirteen South American species. On the other hand, in *Malvastrum*, as I have sought to re-define the genus (Kearney, 1955), Krapovickas (1954, p. 610) found the basic chromosome number to be 6 ($2n = 12, 24, 36$). He considered *Eremalche* to be nearer *Sphaeralcea* than *Malvastrum*, but mentioned a character stated to be unique in Tribe *Malveae* — adherence of the carpel-wall to the seed.

As treated herein, *Sphaeralcea* is the *"Eusphaeralcea"* of an earlier publication (Kearney, 1935), *Malvastrum* the genus as restricted in a recent paper (Kearney, 1955), and *Eremalche* as defined by Wiggins (1951). The more important distinguishing characters of these three genera may be stated as follows:

Sphaeralcea. Carpels (Kearney, 1935, pls. 9–12) 1 to 3-ovulate, apical section smooth, dehiscent, with ventral notch at base, the basal section indehiscent, reticulate. Annual or perennial herbs, the flowers commonly thyrsoid-paniculate, the corolla grenadine-red, varying to mauve-pink (drying violet) or nearly white, also yellow or orange in a few species. Basic chromosone number 5.

Malvastrum. Carpels (Kearney, 1935, pl. 2, figs. E, F, H) 1-ovulate, little differentiated apically and basally but with an (often deep) ventral notch, reniform-suborbicular to almost triangular in outline, incurved-

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rostrate, radially rugose to nearly smooth on the sides, usually pubescent above, with or without dorsal and subapical cusps or tubercles, slightly and tardily dehiscent apically. Perennial (sometimes annual?) herbs or undershrubs, the inflorescences various, the corolla yellow or orange. Basic chromosome number 6.

EREMALCHE. Carpels (Kearney, 1935, pl. 2, fig. G) 1-ovulate, undifferentiated apically and basally, obscurely or shallowly notched ventrally, orbicular or nearly so, muticous, bordered by a radially rugose or reticulate-rugose cushion-like thickening, with smooth or faintly reticulate lateral walls, the carpels indehiscent or tardily and irregularly dehiscent by rupture of the thin lateral walls. Small annual herbs, the flowers solitary in the axils, often long-pedunculate, the corolla whitish to mauve-pink (drying violet). Basic chromosome number 5, at least in *E. exilis*.

Sphaeralcea is widely distributed in western North America, from southern Canada to Mexico, and is also well represented in southern South America. *Malvastrum* ranges from southern Arizona to Florida and the West Indies, south to Bolivia and Argentina. *Eremalche* is confined to the southwestern United States and northern Baja California, perhaps also northern Sonora.

On the basis of my observations on herbarium specimens, a key to the four taxa in *Eremalche* recognized by Wiggins is presented here. The term "taxa" is used because I am uncertain that *E. kernensis* can be maintained as specifically distinct from *E. Parryi*, but in the present state of knowledge I am not prepared to reduce it to subspecific status.

KEY TO THE TAXA

1. Leaves merely coarsely crenate, reniform-orbicular; herbage, involucel, and calyx hispid with long, simple or 2–3 furcate hairs; petals with conspicuous basal spots; carpels 3–3.5 mm. in greatest diameter, thin, flat, rugose-reticulate dorsally and subdorsally and often more finely so laterally, black at maturity. Petals (15?) 20–25 mm. long, lilac or mauve-pink, drying violet. Southern California and Nevada, western Arizona..........*E. rotundifolia* (A. Gray) Greene

1. Leaves palmately 3–5-lobed or -parted; herbage, etc., shortly stellate-pubescent and often with longer simple or sub-simple hairs but all of the pubescence relatively soft and fine; petals without basal spots; carpels not more than 2 mm. in greatest diameter, somewhat turgid, radially rugose dorsally and subdorsally, smooth laterally, pale- to dark-brown at maturity..........(2)

2. Petals not more than 6 mm. long, little surpassing the calyx; peduncles in fruit up to 4 cm. long but usually much shorter; leaves mostly cleft to about the middle, the lobes shallowly few-toothed or nearly entire. Herbage, etc., shortly stellate-pubescent but occasionally with a few longer, simple or subsimple hairs; calyx-lobes lanceolate or ovate-lanceolate, attenuate-acuminate; corolla whitish or pale lavender. Southern California to southwestern Utah, Arizona, and northern Baja California..........*E. exilis* (A. Gray) Greene

2. Petals 8 mm. or longer, much surpassing the calyx; peduncles in fruit often much more than 4 cm. long; leaves usually more deeply dissected and the lobes with more numerous and longer teeth or lobules..........(3)

3. Herbage normally with few or many, relatively long, simple or 2–3-furcate hairs in addition to the short stellate pubescence; calyx-lobes normally ovate and abruptly long-acuminate, but exceptionally lanceolate and attenuate-acuminate; petals mauve-pink, drying violet, 13–26 mm. long. Inner Coast Ranges of southern California, principally in western Kern County....*E. Parryi* (Greene) Greene

3. Herbage shortly stellate-pubescent, occasionally with a few longer hairs; calyx-lobes lanceolate or ovate-lanceolate, attenuate-amuminate; petals whitish or pale lavender, 8–13 mm. long. Apparently restricted to western Kern and San Luis Obispo counties, California ....*E. kernensis* C. B. Wolf

Eremalche rotundifolia is a remarkably uniform species and no intergradation with the other three taxa has been observed. The latter, however, as indicated in the key, seem to intergrade. The possibility that *E. kernensis* originated as a hybrid between *E. Parryi* and *E. exilis* is suggested. It approaches *E. exilis* in character of the pubescence, shape of the calyx-lobes, and corolla-color, but is nearer *E. Parryi* in leaf-shape and size of the corolla. Specimens collected recently by Ernest C. Twisselmann in the Temblor Valley region, western Kern County, California, where the type of *E. kernensis* was found, show various combinations of the characters of *E. Parryi, E. exilis,* and *E. kernensis*. Some of these are probably edaphic variants, as the habitat varied from dry sandy situations to clay-loam and more or less saline flats.

It is probable that biosystematic investigations are needed to solve the problems of this interesting little genus.

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MUHLENBERGIA BRANDEGEI, A NEW SPECIES FROM BAJA CALIFORNIA, MEXICO, AND ITS RELATIONSHIP TO MUHLENBERGIA BILOBA

Charlotte G. Reeder

Early in the year 1889, Townshend Stith Brandegee, botanist and plant collector, set out on the first of several expeditions into Baja California, Mexico. Leaving California by boat, he entered the peninsula at Magdalena Bay in mid-January and apparently spent about six weeks in this general area collecting the plants which he found there. In late February he was joined by two other naturalists from the California Academy of Sciences, Walter E. Bryant and Charles D. Haines. Shortly after the arrival of these men, the three colleagues visited Santa Margarita Island where they spent a week studying and collecting the flora and fauna. Santa Margarita, together with a sister island, Magdalena, lies just off the western coast of southern Baja California and these two islands form the seaward protection to Magdalena Bay. This was not only Brandegee's first, but apparently his only visit to Santa Margarita, an island which remains relatively little known botanically even today. General remarks concerning the trip and the collecting were published by Bryant (1889), his report being concerned principally with the bird life of the area. (For further details of the Brandegee itinerary see: Setchell, 1926; Ewan, 1942; Moran, 1952.) Brandegee, in 1889, published a list of the plants which he had collected early in that year, and in 1891 he decribed, in a general way, both Magdalena and Santa Margarita islands. One of the plants from Santa Margarita Island, a small annual grass listed by Brandegee (1889) as *Bealia mexicana,* is the subject of the present paper.

The geography and geology of these islands was discussed by Lindgren (1890) and Nelson (1921). Of chief concern to us here is a statement by Lindgren that the highest point on Santa Margarita Island is 1900 feet. Nelson (1921) devoted a small section of his account of "Lower California and Its Natural Resources" to the various coastal islands, and there is a short discussion of Santa Margarita. He indicates that the island is mostly barren and desert-like with little plant life. Such vegetation as does exist is primarily in the low middle area and is, for the most part, similar to that of Magdalena Island. He also notes that although these two islands lie close together and are relatively close to the mainland, nevertheless there are several forms of small mammals peculiar to Santa Margarita.

Although Brandegee (1891) entitled his second article, "The Plants Peculiar to Magdalena and Santa Margarita Islands," he included no list of species, but dealt with the geology and some phytogeographic relations of the plants of the area. Since, as he states, the rocks of the highlands of both islands differ in geological composition from those of the nearest mountains of the peninsula, he expected that there might be a considerable number of local endemics even though the two islands are relatively close to each other and to the mainland. This, however, did not prove to be the case, as most of the plants appeared to be the same as those he had encountered in various parts of the peninsula. That there is some degree of endemism, however, is indicated by the fact that Brandegee found a few species, largely inhabitants of the rocks, that he had not collected elsewhere, and most of them proved to be undescribed.

Although he identified the major part of his collections himself, Brandegee sent some groups of plants to authorities for determination. George Vasey of the United States Department of Agriculture identified the Gramineae of the 1889 trip and his report was included by Brandegee (1889, pp. 210–214). Here Vasey placed *"Bealia mexicana* Scribner — Santa Margarita Island" between the species of *Muhlenbergia* and *Sporobolus.* This entry is made more conspicuous than the others by the footnote accompanying it:

> (p. 212). "This grass was first collected by Mr. C. G. Pringle in Chihuahua, Mex., in October, 1886. It was named by Prof. F. L. Scribner, as a new genus, in honor of Prof. W. J. Beal, of the Michigan Agricultural College. I am not aware that a description has been published. It is considered by Prof. Hackel as forming, with *Clomena* Beauv., a section of *Muhlenbergia.* It appears to have pretty strong claims to specific [generic] distinction."

The inclusion with *Clomena* Beauv. was apparently based upon the fact that both possess a bidentate lemma which is awned from between the teeth. This character alone, however, is misleading, and the two complexes are not closely related. In *Bealia* both glumes are 1-nerved, while in *Clomena* the second is 3-nerved and 3-toothed. Beauvois (1812) realized this and stressed it in both his description[1] (p. 28) and in his figure (pl. 7, fig. 10). Species belonging to the *Clomena* complex include *Muhlenbergia peruviana* (Beauv.) Steud. and its close relatives.

The publication of the binomial *Bealia mexicana* apparently dates from Brandegee's paper (1889, p. 212) in which Vasey listed the grasses from Lower California. It should be noted, however, that it is here only a *nomen nudum.* Hackel (1887, p. 47) makes no mention of the genus *Bealia* in the text, although *Clomena* is included as a synonym of *Muhlenbergia.* In his "Nachtrag" (*op. cit.* p. 97), however, we find the following note:

> "S. 47 zu *Mühlenbergia: Clomena* Beauv., wozu auch *Bealia* Scribn., bildet eine Untergattung mit 2zähniger, aus dem Einschnitte begrannter Decksp., in Mexiko und Peru."

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[1] Beauvois states that the lower glume is tridentate, but this is obviously an error. His figure correctly shows that the first glume is entire and 1-nerved, while it is the upper (second) which is 3-nerved. Niles (1925, pp. 162, 163) translates the Beauvois manuscript, but makes no mention of this discrepancy.

This addendum accounts for the comment inserted under *Muhlenbergia* in Scribner's translation of the Hackel manuscript (1890) and the subsequent consideration of *Bealia* as a synonym of *Muhlenbergia*. That Scribner did not agree with Hackel's disposition of *Bealia,* however, is evident from his comment in a footnote under *Muhlenbergia* on p. 104 of the translation. In this footnote Scribner discusses at some length the distinctions between that genus and *Bealia,* and ends with the statement: ". . . I can but consider it [*Bealia*] generically distinct." In this footnote the genus is described only superficially and no specimens are cited, but an original figure (45a) by Scribner shows the spikelet and its various parts in detail. The legend under the figure bears the name "*Bealia Mexicana,* Scribner (provisional.)"

It was not until six years later that an adequate description of *Bealia mexicana* was published, and this by Beal (1896, pp. 267, 268) himself, although he credits the name to Scribner. In the same publication Beal makes the new combination *Bealia speciosa* which is based on *Muhlenbergia speciosa* Vasey. These two specific epithets are the only ones which have ever been associated with the generic name *Bealia*. Our present concern is only with *Bealia mexicana,* since *B. speciosa* appears to be a valid Mexican perennial species of *Muhlenbergia* (see Hitchcock, 1935, p. 457).

In the amplified diagnosis of *Bealia mexicana,* Professor Beal states that the plant is "an elegant tufted perennial, 20–40 cm. high." A Pringle specimen (no. *819*) from the State of Chihuahua, Mexico, is the only collection cited. Actually specimens of this collection, which are still extant, show that the plants were certainly annual in growth habit.

The chief characters which served to separate *Bealia* from *Muhlenbergia* were the deeply bifid lemma, between the lobes of which an awn arises, as well as the long, faintly-nerved glumes, which commonly exceed the lemma in length. These characters are present also to a greater or less degree in those *Muhlenbergia* species which are sometimes rcognized as the distinct genus *Epicampes* Presl, all of whose species are stout perennials. Despite its annual habit, if *Bealia mexicana* were not to be recognized as a member of the genus *Muhlenbergia,* it would appear to belong to the genus *Epicampes,* a disposition which was made of it by M. E. Jones (1912). At present, however, *Bealia* is not recognized, and *Epicampes* usually is considered as little more than a section of *Muhlenbergia*.

Hitchcock (1913), reporting on the Mexican grasses in the United States National Herbarium, attempted to clarify the situation by (1) transferring *Bealia mexicana* to *Muhlenbergia;* (2) pointing out that the combination *Muhlenbergia mexicana* was not tenable since the epithet *mexicana* had been preempted in the genus by *M. mexicana* (L.) Trin. in 1824; (3) proposing a substitute name, *M. biloba;* and (4) citing the collections then presumed to represent the species, which included the type (*Pringle 819*) from Chihuahua; *Pringle 10147* from Durango; and *Brandegee* in *1889* from Santa Margarita Island.

In a later work, Hitchcock (1935, pp. 436, 437) gave the type locality as "Chihuahua City, (*Pringle 819*)" and the distribution as "Gravelly hills, Baja California to Durango."

I. M. Johnston (1943), apparently following Hitchcock's lead, said of *Muhlenbergia biloba:* "Known from a few stations in Baja California, Chihuahua, and Durango."

Conzatti (1946) in his "Flora Taxonomica Mexicana," evidently following Hitchcock, includes *Muhlenbergia biloba* and cites the same three localities. It is interesting to note that Conzatti, in the synonymy, gives the impression that *Bealia mexicana* Scribn. ex Beal (1896) is based on *Muhlenbergia mexicana* (L.) Trin. This, as we have seen, is not true; rather, it is the reason for the new binomial.

Pringle collected many replicates and consequently his specimens are distributed rather widely. The Brandegee collection, on the other hand, apparently was more restricted, and to my knowledge specimens are to be seen in only two herbaria.

In addition to the three collections cited by Hitchcock as *Muhlenbergia biloba,* there is yet a fourth, overlooked by most authors, but brought to my attention by an entry in Pringle's journal (Davis, 1936, p. 36):

> "Oct. 7, (1886). A great day for us. Rising at daybreak at 6:40 A.M. we were on our way to the northwestern hills. There we secured two species of *Cyperus,* 811 *C. amabilis* Vahl and 810 *C. Hochstetteri* Nees, and a large supply of a strange grass of which last year I found but two specimens in a wash — 819 *Bealia mexicana* Scribner."

In the itemized list of Pringle's specimens (Davis, 1936, p. 340), there are three separate numbers given under *Bealia mexicana.* In addition to *819* (type) and *10147* (cited by Hitchcock, 1913), there is a third, *501.* A sheet in the Pringle Herbarium bearing this number (*501*), which I have examined, contains two small plants. This collection, which is from the same general locality as the type, is apparently that referred to by Pringle in the quotation above and thus represents all of the material of this species which he found in 1885. While all of the Pringle collections appear to be conspecific, the one from Durango (*10147*) differs slightly from the other two. It has longer hairs on the glumes, shorter hairs on the palea, and the glumes and floret are about equal in length. These slight differences, however, seem to be well within the range of variability of the species.

While the specimens from Chihuahua and Durango are certainly conspecific, the Brandegee collection from Baja California, even though apparently related to *Muhlenbergia biloba,* differs in morphological details which appear to be of such a magnitude as to represent a distinct species. The geographical ranges of the two taxa moreover appear to be quite distinct. Since a new specific epithet is required, I should like to name this new taxon in honor of the collector, T. S. Brandegee, a Yale alumnus, who did so much to further the botanical knowledge of Mexico and California.

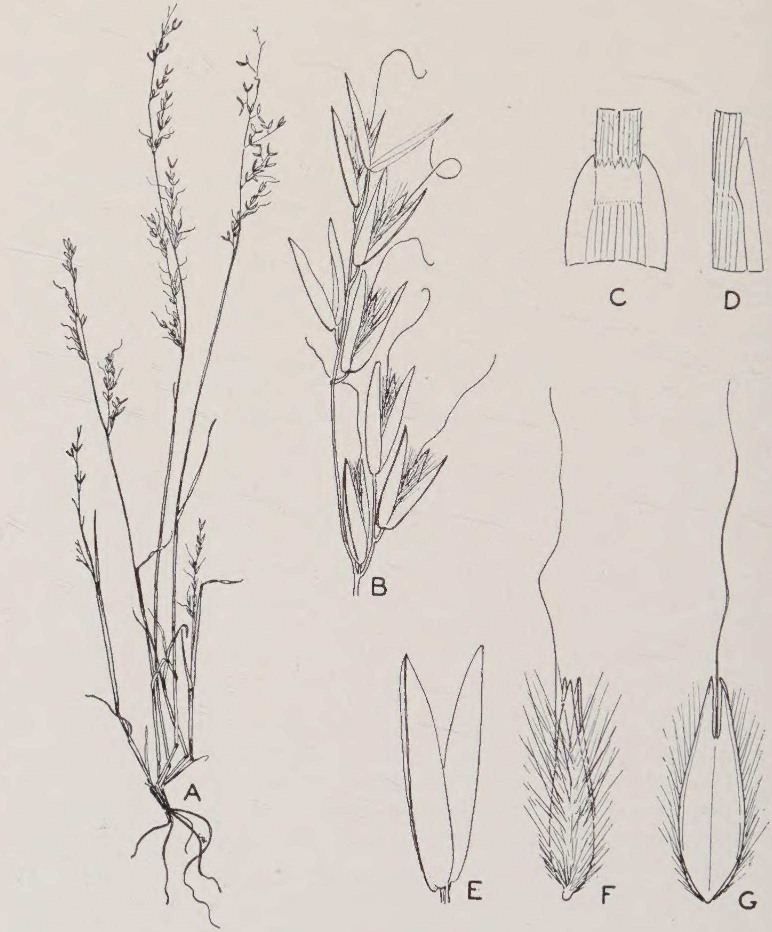

FIG. 1. *Muhlenbergia Brandegei* C. G. Reeder. A, habit, × ½; B, panicle branch with spikelets; C and D, two views of ligule (B–D, × 5); E. glumes; F, floret; G, lemma flattened out, adaxial view (E–G, × 10). From type specimen (*Brandegee 16* in 1889).

Muhlenbergia Brandegei sp. nov. Annua, 15–25 cm. alta; culmis teretibus purpureis striatis plus minusve glabris erectis vel adscendentibus, nodis glabris fuscis inferioribus multiramulosis; vaginis glabris vel minute scabris quam internodiis plerumque brevioribus, marginibus scariosis; ligule membranacea erosa circiter 0.7–0.8 mm. longa sed marginibus in dentes subulatos ad 1.5 mm. longis extendentibus; laminis planis vel apicem versus plus minusve subinvolutis 3–4 (raro ad 7) cm. longis 1–1.5 (raro ad 2) mm. latis, subtus scaberulis, supra sparsim pubescentibus; panicula contracta pallido-viride 3–10 cm. longa, rhachi striata, ramis

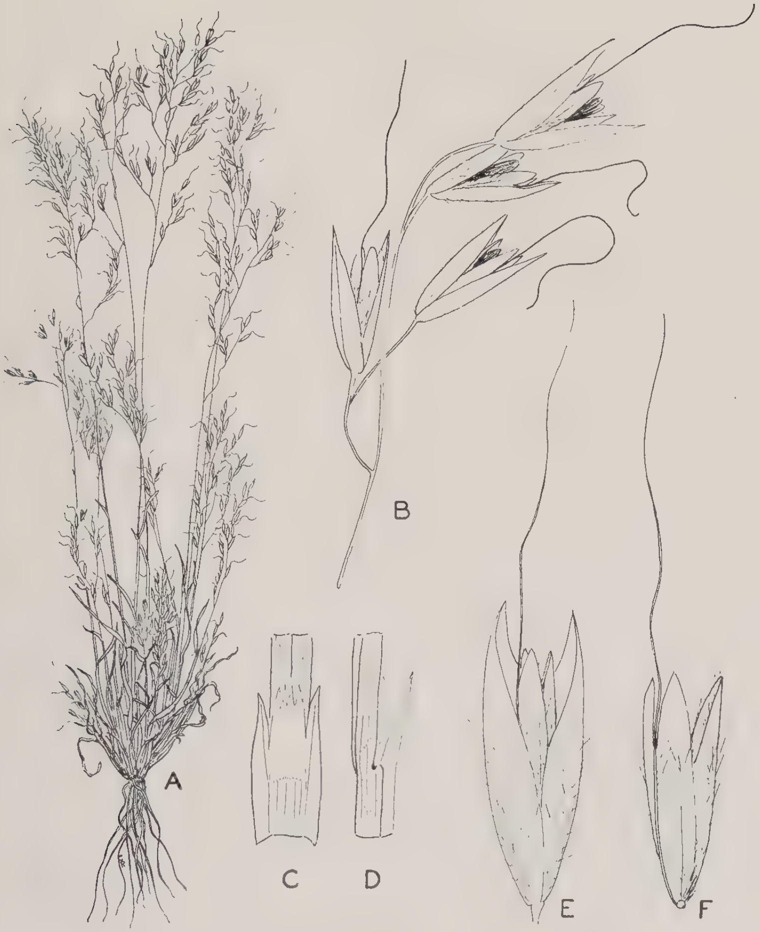

FIG. 2. *Muhlenbergia biloba* Hitchc. A, habit, × ½; B, panicle branch with spikelets; C and D, two views of ligule (B–D, × 5); E. spikelet; F, floret (E–F, × 10). From type collection (*Pringle 819*).

adscendentibus e base plerumque densifloris; pedicellis angularibus adpressis 1–3 mm. longis; spiculis circiter 3 mm. longis; glumis subaequalibus 1-nerviis plus minusve glabris sed sub lente minute papilloso-asperis; lemmate circiter 2.5–2.8 mm. longo quam glumis paullo breviore dense pubescente (pilis albis rigidis basim versus brevibus apicem versus gradatim longioribus), apice acuminato bifido, dentibus ad 1 mm. longis; arista flexuosa scaberula 7–8 mm. longa e apice lemmatas bifida exserta; antheris circiter 1 mm. longis; caryopsis 1.4 mm. longa.

LOWER CALIFORNIA, MEXICO: Santa Margarita Island, *T. S. Brandegee 16* (UC, type; US). March 6, 1889.

TABLE 1. SUMMARY OF CHARACTERS DISTINGUISHING MUHLENBERGIA BILOBA FROM M. BRANDEGEI

	M. Brandegei (see fig. 1)	*M. biloba* (see fig. 2)
Glume length	3 to 3.5 mm.	4 to 5 mm.
Glume surface	glabrous (minutely papillose-roughened under a lens)	pubescent, especially on the lower ⅔
Glume nerve	prominent, green	indistinct
Lemma length (including teeth)	about 2.5 to 2.8 mm.	3 to 3.5 mm.
Lemma surface	densely stiff pubescent on lower ½ to ⅔'s; hairs white, short below, longer above	sparsely appressed tawny pubescent on about lower ⅔
Lemma teeth	acuminate to aristate, erect	± rounded, broadly toothed, spreading
Lemma nerves	3 prominent, the nerves evident even in the teeth when opened out	1 prominent, the lateral nerves indistinct above, more evident on lower ½
Anther length	1 mm.	2 mm.
Pedicels	angular	terete
Panicle	contracted, branchlets and pedicels stiffly appressed along the axis; the main branches ascending or appressed, mostly spikelet-bearing for entire length	somewhat open, with branchlets and pedicels ascending to spreading, ± flexuous; spikelet-bearing on terminal half
Ligule length	1 to 1.5 mm.	2.5 to 3 mm.
Flowering time	March (plants mature)	September and October
Distribution	Baja California: Santa Margarita Island. Not over 1900 feet elevation	Chihuahua and Durango, in the mountains, elevation from 4700 to 6800 feet

As pointed out above, *Muhlenbergia Brandegei,* which appears to be endemic to Santa Margarita Island, has been confused with *M. biloba* Hitchc. from the time of its discovery. For this reason, the complete synonomy of *M. biloba* is given below, along with a list of the specimens examined. I believe that this short list represents all the collections that have been made of this species.

MUHLENBERGIA BILOBA Hitchcock, Contr. U. S. Nat. Herb. 17: 294. 1913; N. Am. Fl. 17 (6): 436. 1935. *Bealia mexicana* Scribner ex Vasey, in Brandegee, Proc. Calif. Acad. Sci. II. 2: 212. 1889, *nomen;* in Scribner & Southworth, The True Grasses p. 103, fig. 45a. 1890, *nomen;* ex Beal, Grasses N. Am. 2: 267. 1896, descr. [basis of *Muhlenbergia biloba* Hitchc.]. *Epicampes mexicana* (Scribner ex Beal) M. E. Jones, Contr. West. Bot. 14: 7. 1912. Not *Muhlenbergia mexicana* (L.) Trin. 1824.

Specimens examined: MEXICO. CHIHUAHUA: [vicinity of Chihuahua City], thin soil of porphyry mountains, October, 1886, *Pringle 810,* US (type), F, GH, MO, NY, VT, UC (not seen), YU; hills west of Chihuahua, October 21, 1885, *Pringle 501,* VT; Majalca [north of Chihuahua City], September 16, 1935, *Le Sueur Mex-026,* CAS (not seen), GH, MO, UC, US. DURANGO: Barranca below Sandía Station, 6800 feet elevation, October 12, 1905, *Pringle 10147,* CAS (not seen), F, MO, NY, UC (not seen), US, VT. [According to Davis (1936, p. 228) on October 12, 1905, Pringle was on the Mesa de la Sandía at the base of the Sierra Madre Range.]

Although *Muhlenbergia biloba* and *M. Brandegei* resemble each other in certain characters, they are apparently not as closely related as was once supposed. The important differences are summarized in Table 1.

ACKNOWLEDGMENTS

I am indebted to the curators of the following herbaria for the loan of specimens: the University of California at Berkeley (UC), Chicago Natural History Museum (F), Gray Herbarium (GH), Missouri Botanical Garden (MO), New York Botanical Garden (NY), U. S. National Herbarium (US), and Pringle Herbarium of the University of Vermont (VT). Especial thanks are due the head curators of the United States National Herbarium and of the New York Botanical Garden for making the facilities of their respective institutions available on numerous occasions, and my husband, John R. Reeder, for his endless help throughout the course of the study.

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PHYTOSEROLOGY VERSUS GENEALOGY IN ZEA MAYS[1]

J. F. Davidson and T. L. Thompson

For many years the ideas of phytoserology, as expounded by Mez (1936) and by Chester (1937), have intrigued the senior author as being potentially highly significant in the field of plant taxonomy. Discussions with the junior author, and with his colleague, Dr. Warren Engelhard, stimulated a desire to attempt some phytoserological tests. While it is obvious from the literature that phytoserology has yielded taxonomic data, (i.e., data which give evidence of proximity of relationship), there is no assurance that these data are valid. In short, do the data obtained from serological studies accurately reflect the genealogies of the individuals in question? This was our problem.

In order to set up a test for the validity of phytoserology in taxonomy, it was necessary to find plants of *known* genetic (genealogical) relationships. It was felt that checking members of the same genus against members of other genera in the same plant family, or against members from other families, would not be accurate enough, since such relationships are *assumed*, not definitely known. It is true that such assumptions are based upon many data, and are probably valid, but the authors wished to test definite, not probable, genealogies. With the thought that *Zea Mays* had been bred for many years, the authors approached the corn breeders to see if they could obtain some strains of known genealogy. Many of their stocks were of *presumed* closer or more distant relationship, but the genealogies of some were *known*.

Through the gratefully appreciated cooperation of the Department of

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[1] This work was financed by a grant from the University of Nebraska Research Council, whose cooperation is hereby gratefully acknowledged.

Agronomy of the University of Nebraska, we obtained six strains of corn in which the genealogies were known. In the interest of simplicity, the agronomists selected sample No. 1 as the reference sample, so that the others were more or less distantly related to No. 1. We arranged with the agronomists that after the serological relationships of the six samples had been determined, a check would be made against the recorded genealogies of the samples involved.

While the principles of serology are available in any standard textbook, such as Boyd (1943) or Rabat and Mayer (1948), the senior author has considered it advisable, in the interest of completeness, to include the following resumé of the serological principles as they apply to plant taxonomy. Furthermore, since the great majority of taxonomists are not familiar with the methodology, it is presented here in considerable detail.

The basis for phytoserology rests in the thesis that although the total protein constitution of a plant is antigenically different from that of any other plant, certain proteins are found in common in closely related individuals. Although each plant specimen is considered to possess some proteins that are peculiarly its own as an individual, still, genetic processes pass common proteins along to their offspring. Thus, those plants which are more closely related genetically are presumed to have a greater number of proteins in common.

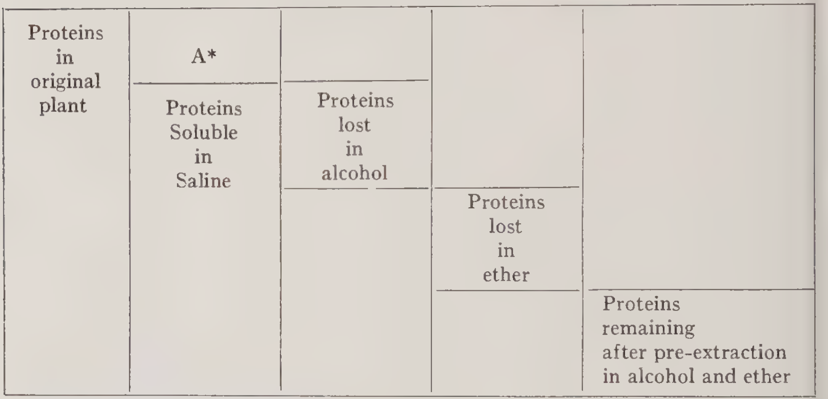
A protein, when injected into the blood stream of a laboratory animal, may stimulate the formation of *antibodies* in the serum. The injected protein is termed the *antigen*. Injections of the same protein at frequent intervals may increase the concentration of the antibodies in the blood serum. If, after a "rest from injection" period, the serum is withdrawn from the animal and the original protein (antigen) is added to the serum, the anti-bodies present in the serum react with the antigen. In some instances, this reaction may express itself visually as agglutination or precipitation. In other instances it is necessary to employ "indicator" systems to detect the reaction. If the proteins are efficient as antigens, and if they are present in sufficient amounts, either the serum or the antigen may be greatly diluted (1:10,000) and still give a discernible reaction. Thus, unknown antigens may be checked against the antibodies present in the serum by making a series of dilutions for each unknown antigen, adding a standard amount of serum, and seeing at what dilutions the reaction is apparent. The greater the dilution showing a reaction, presumably the greater the number or amount of common proteins.

For antigen injection, it is desirable to employ an isotonic dilutent to avoid possible shock to the experimental animals. Thus, antigens which are insoluble in the dilutent used are not available for testing. The most common dilutent employed is physiological saline solution. However, when plant materials are extracted in a dilutent they frequently contain substances which are toxic to the test animals. Such toxins are commonly removed by one or several pre-extractions with some other solvent, such as ethyl alcohol or sulphuric ether. The solutions resulting from such pre-extractions are discarded, and the plant material is then extracted in the physiological dilutent.

In certain tests in immunology it is desirable to inject either a single protein or a small number of proteins. Hence, the original extract is normally purified by successive pre-extractions with various organic solvents, thus eliminating the undesirable fractions.

However, in taxonomic work, there is no method of predetermining which proteins, if any, characterize the various phyletic lines. It is preferable, therefore, to have both the maximum amount and maximum number of proteins present. For this reason, in taxonomic work it is desirable that pre-extraction procedures, as shown in Chart 1, should be kept to a minimum.

Chart 1. Sequence of Pre-extraction Procedures


Proteins in original plant
A*
Proteins Soluble in Saline
Proteins lost in alcohol
Proteins lost in ether
Proteins remaining after pre-extraction in alcohol and ether

*A = Proteins insoluble in saline.

From this chart it can be seen that not all the proteins in the plant are necessarily soluble in saline. We have no method of determining or testing fraction A. The maximum we can test is the amounts or kinds present in the saline solution. Each succeeding pre-extraction reduces the number and/or kinds of protein tested. If the characteristic proteins of a genealogical lineage are not present in the antigen, the serological results cannot be indicative of the lineage.

Procedure

Preparation of Antigens. Corn was selected for the experimental plants because of the *known* genealogies. Since the corn fruit is a genetic mixture, as far as tissues are concerned, with fruit coat which is strictly maternal, endosperm which is largely maternal, and embryo which is half maternal and half paternal, only the young plant, derived from the embryo was used. It was felt that the use of the grain itself would introduce probable errors.

The six samples of corn were planted in vermiculite, 50 plants per flat, one flat per sample. They were harvested after 38 days and each plant was uprooted and the whole plant was cut up with shears into one-fourth to one-half inch pieces. Any remnants of the original grain were discarded. From each sample, 400 grams of plant material were used. This material was pulverized, 25 grams at a time, in 200 ml. of physiological saline in a Waring Blendor for 45 seconds. The resultant mixture was squeezed through cotton toweling and the debris was discarded. (The authors now feel that it might have been wise to have allowed the mixture to extract overnight in a refrigerator before the above rough filtration, as a possible method of increasing the protein concentration.)

The extractions were held overnight at 5°C. and were then centrifuged 30 minutes at 2,000 r.p.m. After centrifuging, the residue was discarded and the supernatant was passed through a sterile Seitz filter. The filtered extract was transferred to 200 ml. rubber-capped serum bottles, and 1:10,000 Merthiolate was added as a preservative. Extracts were stored at 0°C. until needed.

Nitrogen determinations were made by the colorimetric method of Miller and Miller (1948). Prior to the serological experiments, each sample was adjusted to contain 0.16 mg. of nitrogen per ml. The six samples varied as shown:

TABLE 1. VARIATION IN NITROGEN CONTENT OF EXTRACT

Sample No.	N in mg./ml.	Diluted to
1	0.20	8 in 10
2	0.40	8 in 20
3	0.50	8 in 25
4	0.16	undiluted
5	0.24	8 in 12
6	0.18	8 in 9

TEST ANIMALS. Preliminary experiments indicated that mature rabbits did not produce a good antibody titer in response to the corn proteins. Good titers were, however, obtained when rabbits two months of age were employed.

INJECTION OF ANTIGEN. The animals were injected every fourth day with the amounts of plant extract No. 1 shown in Table 2. Four injection routes were employed to determine the most efficient in building up the antibody titer (see Table 4). These were: intravenous, intraperitoneal, intramuscular, and subcutaneous.

The intravenous and intraperitoneal routes proved to give the highest titers, and since these titers were both approximately equivalent, the intraperitoneal route was employed as being the easier to administer.

TUBE AGGLUTINATION TESTS. For preliminary titrations, 5 ml. of blood were withdrawn from the terminal ear vein, and allowed to clot at room

TABLE 2. INJECTION ROUTES AND QUANTITIES

	Millimeters injected			
Day	Intravenous	Intra-peritoneal*	Intra-muscular*	Subcutaneous
1	0.2 ml.	0.5 ml.	0.5 ml.	0.5 ml.
4	0.4	1.0	1.0	1.0
8	0.8	2.0	2.0	2.0
12	1.0	2.0	2.0	2.0
16	2.0	5.0	5.0	5.0
23	Animals bled, preliminary titer determined.			
37	2.0	5.0		
51	Final bleeding.			

*Addition of an adjuvant (mucin) did not enhance the antibody titer.

temperature. The clots were broken, and the serum was separated by centrifugation at 3,000 r.p.m. for 30 minutes. The serum was serially diluted with physiological saline as follows: 0, 1:2, 1:4, 1:8 up to 1:256. One ml. of each dilution was pipetted to a serological tube, one ml. of antigen diluted 1:10 was added, and the tubes were shaken vigorously. The tubes were then incubated at 37°C., and observed at intervals over an 8-hour period. A reciprocal test was also set up using antigen dilutions and a constant amount of a 1:2 dilution of serum.

RING PRECIPITATION TESTS. Small amounts of undiluted serum were introduced into 5 cm. micro tubes with a bore of 2 mm. By means of a capillary pipette, each antigen dilution was carefully overlaid on the surface of the serum. The tubes were incubated at 37°C., and checked at intervals for the characteristic precipitin ring at the interface.

Titers obtained from these two methods were disappointingly low. In no instance did the titer exceed 1:32.

In order to determine the effect of incubation temperature on agglutination, tubes were incubated at 5°C., 25°C., and 37°C. Incubation temperature was found to have no effect on the final titer.

It had originally been planned to employ agglutination tests, and to run cross-agglutinations to determine more accurately the relationship of the corn samples. However, in view of the low titers obtained, cross-agglutination reactions would have been of little value. Therefore, it was decided to check for the presence of complement-fixing antibodies.

COMPLEMENT FIXATION REACTION. The theory of complement fixation is predicated upon the following facts:

1. Complement, a protein, is always present in normal serum.
2. Certain immunological reactions require the presence of complement.
3. These reactions are not visible.
4. Hemolysin, an antibody produced by injecting sheep red blood cells (RBC) into rabbits, will lyse sheep red blood cells *only* in the presence of complement.

Where complement-fixing antibodies are produced, their presence is detected in the following manner. The serum is heated for 30 minutes at 55°C. to inactivate its complement, and some antigen plus an optimal amount of pure complement is added. This mixture is incubated to allow the antigen and complement-fixing antibodies to tie up the complement. Then anti-sheep hemolysin, in known amount, and sheep red blood cells are added and incubated for 30 minutes at 37°C. If all of the complement has been tied up by the antigen-antibody reaction, none will be available to react with the hemolysin to lyse the red blood cells. If only a small amount of complement-fixing antibodies is present, some of the complement will be available, and lysis will occur. The tube containing the lowest dilution of serum which shows complete lysis is taken as an indication of the titer.

Titration of Hemolysin for Optimal Amount. Using 1 ml. of 1:30 dilution of purified complement, a series of dilutions of hemolysin were added to determine the dilution that gave complete lysis in 30 minutes at 37°C. This amount of hemolysin is one unit. Two units were used in the final test.

Titration of Complement for Optimal Amount. Using two units of hemolysin, dilutions of complement were made to determine the dilution that gave complete lysis in 30 minutes at 37°C. This amount of complement is one unit. Two units of complement were used in the final test.

A further complication arising in the present work was due to the fact that the corn extracts apparently contained some substance which inactivated or destroyed the complement. This was controlled by diluting the antigen 1:1 and by adding sufficient complement to offset this reaction.

Table 3. Complement Fixation Test on Corn Samples

Tube	Dilution of serum	Antigen* Diluted 1:1	2 units complem. 1/30 dil.		Saline	Hemolysin 2 units	Red blood cells 3%	
1	0.	.25 ml.	1.75 ml.	Refrigerate 20 hours at 5°C.	0. ml.	0.25 ml.	0.25 ml.	Incubate for 30 minutes at 37°C., and read.
2	1:112							
3	1:24							
4	1:48							
5	1:96							
6	1:192							
7	1:384							
8	1:768							
9	1:1536							
10	1:3072							
Hemol. control		0	1.75		.75			
Comp. control		0	1.75		1.00	0		
Sensit. cont.		0	0		2.50	0.25	0.25	
Cell control		0	0		2.75	0	0.25	
Serum control		0	1.75		.75	0.25	0.25	

*The first ten tubes were repeated for each antigen.

TABLE 4. RESULTS OF COMPLEMENT FIXATION TEST

Antigen	Control	1/12	1/24	1/48	1/96	1/192	1/384	1/768	1/1536	1/3072	Tit
1	+++	—	—	—	—	—	+—	+—	+—	(+++)	30
2	+++	—	—	—	—	+—	(+++)	+—	+++	+++	3
3	+++	—	—	—	—	+—	+—	(+++)	+++	+++	7
4	+++	—	—	—	—	—	—	+—	+—	(+++)	30
5	+++	—	—	—	—	+—	+—	+—	(+++)	+++	15
6	+++	—	—	—	—	+—	(+++)	+++	+++	+++	3
Hemol.	+++										
Comp.	—										
Sensit.	—										
RBC	—										
Serum	+++										

+++ complete lysis
— complete inhibition
( ) titer

Best results were obtained when the antigen and serum were incubated with the complement at 5°C. for 20 hours.

After the preliminary titer from the injection of antigen had attained a value of over 1:3,000, the other antigens were tested as shown in Table 3. The results of this test appear in Table 4.

From the above it would appear that, as far as similarity of proteins is concerned, samples 1 and 4 are most closely related, and that the remainder are, in order of similarity, 5, 3, with 2 and 6 being equally distant from 1. This might be shown graphically as:

1 2
5 3
4 6

DISCUSSION

After the above results had been obtained, the genealogy of the samples was requested from the Department of Agronomy. The samples represented the following plants:

1. Dent corn N 6
2. Dent corn hybrid L 289 × I 205
3. Dent corn 38-11
4. Pop corn SA 24
5. Dent corn N 6 (from a sister plant to sample 1)
6. Dent corn hybrid L 289 × I 205 (from the same plant as 2)

The relationship of these plants, as given by the geneticists who know the genealogies is as follows: 1 and 5 are very closely related, being sister plants; next is the pure line, 3; then 2 and 6, being from the same plant; and most distantly related is the popcorn, sample 4. This can be shown graphically as:

2
1 5 3 4
6

It is interesting to notice that, with the exception of the popcorn (4), the serology reflects the genealogy quite well. While the serology was able to distinguish between the sister plants (1 and 5), it was unable to distinguish between fruits from the same individual (2 and 6). These latter results would indicate that the methodology was sound, but because of the exception noted above, it would appear that serology of itself cannot be accepted as an adequate criterion of relationship. Within known groups, such as the dent corn samples utilized, it appears to be valid — at least from this limited series of experiments. As with most taxonomic tools, it would seem that serological data should be correlated with evidence from other fields to be significant.

SUMMARY

Six samples of corn of *known* genealogy were tested by serological methods to determine whether or not the serological relationships were an accurate reflection of the genealogical relationships. The serological procedures are given. Results indicate that within the dent corns the serology did deflect the genealogical relationships, but the inability of serological techniques to distinguish between a dent corn and a popcorn demonstrates that serology of itself cannot be used as a valid clue to genealogical relationships in every case.

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JOSEPH BURKE IN 1853

R. KENT BEATTIE

In her recently published work on the history of botanical exploration west of the Mississippi (McKelvey, Susan Delano. Botanical Exploration of the Trans-Mississippi West 1790–1850. Arnold Arboretum, pages 792–817. 1955), Mrs. McKelvey gives a very excellent and adequate account of the botanical explorations of Joseph Burke in western Canada and the western United States in the years 1843 to 1847. For years, little has been known by botanists about Burke's work except that he collected some plants around "Fort Hall" in what is now known as southern Idaho. We had learned that there was material about Burke at Kew, but no one had secured copies of it for study. Mrs. McKelvey obtained photostats and microfilms which are now at the Gray Herbarium. She traces his explorations in America from 1 March 1844 to 6 November 1847. During this period he was east of the Rocky Mountains in Canada till the autumn of 1844, then crossed the Rocky Mountains and went down the Columbia to Old Fort Walla Walla and east to Fort Hall not far north of what is now Pocatello, Idaho. It has been assumed that he then returned to England.

On page 817 of her book, Mrs. McKelvey says:

"It would be interesting to know what Burke did in later years but the curtain falls at this point on what seems (to me) to have been a sorry story, for the unfortunate Burke certainly."

The author of this note wishes to report that there is in the New York Botanic Garden Herbarium a specimen collected by Joseph Burke in western Missouri in 1853 and sent to Dr. Torrey accompanied by a letter from Burke to Torrey. Torrey named the plant *Hibiscus militaris* and it is today filed under that name in the Garden Herbarium. The letter is on file in the Library. The Garden very kindly had a photograph of the specimen and a photostat of the letter prepared for me, and for the courtesy I thank it and especially the Head Curator, David D. Keck, and the Librarian, Miss Elizabeth C. Hall.

The letter from Mr. Burke to Dr. Torrey follows:

Arrd. Oct. 14th Harrisonville, Cass Co., Mo.
Sept. 29th, 1853

Dr. Torrey, Professor of Botany esq.

Sir: I take the liberty of writing you concerning a plant I found a few days since.

Although I am a total stranger to you — you are well known to me by reputation — knowing your great love of Botany encouraged me to write freely to you concerning the plant that interests me so much — had I your work I have no doubt I could satisfy myself without giving you trouble for I can scarcely hope it is a new sps. As near as I can remember it is Hibiscus — at present I have no work to refer to — About five years ago I lost all my books. They were freighted & insured from New York to Oregon City. I have traced them to San Francisco and no farther. I have no doubt they have been burnt in that place —

As they are insured with the Atlantic Mutual Insurance Co. I have no doubt I shall get my money after a time, and then be able to make up my book losses again —

The Hibiscus? I forward you is not a good specimen. It was about the last flower of the season — I was several miles from home seeking horses, when I found it. As I had no proper means of saving it, it is very much damaged — I found it growing in a moist very rich alluvial soil, by the side of a prairie water hole, that is supplied by the rains — It is a perennial sending up many shoots of about 5 feet 6 inches in length —

About the Christmas of the year 41 I found a very pretty Hibiscus in the interior of South Africa near the Cashan Mountains which the Dutch immigrants call Macali's berg from a chief named Macali that lives in that region of country — Near the place I found the Hibiscus & amongst the mountains I found many fine plants — the Hibiscus and a few others are figured in Hooker's continuation of Curtis. I think in the year 43 several are figured in Sir W. J. Hooker's Icones plantarum. One is a leguminous tree which Sir W. J. H. has honored me by calling after my name. I have seen none of these figures, as I have scarcely been in England since.

When the gold was first discovered in California, I went there — I spent all the time collecting, that I could not mine — My Herbarium was all lost — I sent a quantity of seeds to Europe according to former promises — I also sent a collection of reptiles and Coleopterous insects to the British Museum — I suppose they were also lost as I have heard nothing of them since — I have sent several collections of Coleoptera to Milby, the great Entomologist of Liverpool — As I have never heard anything of them since — I have great reason to believe they were also lost —

If you have a friend or acquaintance that is interested in Coleoptera I have a small bottle at his service, which I have collected on my own farm, & would feel happy to forward the first opportunity.

I am sir, with much respect, your most obedient servant.

Joseph Burke

Evidently Burke was in California in 1849 or 1850 and later moved to Harrisonville, Cass County, Missouri and lived there on the 29th of September 1853.

This "raises the curtain" for Burke for five years, ten months and twenty-three days.

Piney Branch Farm,
Glen Mill Road, Route 1,
Rockville, Maryland.

A NEW GOSSYPIUM FROM MICHOACAN, MEXICO

Howard Scott Gentry

Gossypium lobatum sp. nov. Arbor 6–9 m. alta; truncus ca. 2 m. longus, 15–20 cm. diam. cortice griseo; rami badii, graciles, patuli, paucipunctati; lamina folii 3–5-lobata, cordata, 7–12 cm. longa et subaequilata vel latior, stellato-pubescens, apice, acuminata; pedunculi 7–9 mm. longi, glabri, bracteolis ovatis obtusis, glabris, persistentibus, 4–5 mm. longis, lignosis; calyx 5-lobatus, campanulatus, 20–22 mm. longus, lobis 9–10 mm. longis, triangulo-lanceolatis; corolla punicea, 5-5.5 cm. longa, tubiformis, intra ad basim purpurea; capsula 3-loculata, 25–30 cm. longa; semina oblonga angustissima ca. 1 cm. longa dense et longe pilosa pilis crispatis pallidis.

Slender tree 6–9 m. tall with single stem ca. 2 m. high, 15–20 cm. in diameter, bark light gray on trunk, dark or reddish-brown on branches and young stems with conspicuous scattered lenticels, these transversely elongate or 1–2 mm. broad parallel to horizontal ridges; branches slender, flexuous, spreading, the nodes remote, sparsely dotted with light-colored round lenticels, glabrate, the young twigs stellate-pubescent; petioles stellate-pubescent, 2–4 cm. long, abscising at base; leaf blades 3–5-lobed, broader than long, mostly 7–12 cm. long (from apex of petiole), 8–14 cm. broad, the central lobes acuminate, stellate-pubescent above and below, paler below; venation primarily 5-palmate, but lower pair conspicuously weaker and frequently anastomosing above without lobation; flowers axillary in the 2–3 distal nodes, 1–several at a node; pedicels 7–9 mm. long, glabrous, abscising at the base; bracteoles ovate-obtuse from a triangular base, glabrous, striate and gland-dotted, 4–5 mm. long, persistent, lignified in age; calyx at anthesis campanulate, 20–22 mm. long, the tube ca. 12 mm. long, densely long-stellate-pubescent, the lobes 9–10 mm. long, triangular-lanceolate, equal, ochroleucous, sparsely stellate-pubescent, sparsely gland-dotted; corolla 5–5.5 cm. long, tubular in form with strictly imbricate petals, finely gland-dotted and stellate-pubescent externally, light pink with a deep purple fimbriated spot covering lower half within; androecium 2.5–3 cm. long; apical filaments longer than the proximal ones; capsules 3-locular, 25–30 cm. long, narrowly ovoid, acuminately to obtusely beaked, densely rugose-punctate towards apex, less so below, the valves rather thin; seeds narrow, elongate, short-linted with fibers 2–4 mm. long, ca. 10 mm. long, 2–2.5 mm. in diameter at middle, tapered, the raphe forming a naked groove nearly as long as the seed; seed coat dark brown, smooth, waxy.

Type. Canyon del Marques at about 500 m. elevation, along highway between Uruapan and Apatzingan, Michoacan, Mexico, October 22, 1952, *Gentry 12314* (U. S. Nat. Herb. 2189410). Additional material used in the diagnosis from the same population is fruiting material collected May 12, 1951, *Gentry 10450* (U. S. Nat. Herb. 2189412). Seed of this collection grown at Iguala, Guerrero, produced the flower, *Kerr s.n.* (U. S. Nat. Herb. 2189413).

The specific name, *lobatum*, refers to the lobes of the calyx, which are conspicuously larger than those of other members now known in the genus.

This species belongs in Hutchinson's section *Erioxyla* (1947) and is closely related to *Gossypium aridum* (Rose and Standley) Skovsted (1934, p. 422; 1935). It is distinguished from the latter by: (1) the lack of spur-branchlets, (2) the broad lobate leaves (vs. entire small leaves), (3) the glabrous pedicel and involucel (vs. densely pubescent), and (4) the large campanulate, deeply lobed, long-pubescent calyx (vs. smaller, cupulate, short-lobed, short-pubescent). It is distinguished from *G. aridum* and from all other species of *Gossypium* by the yellowish-green foliage, by the large deeply lobed, long-pubescent calyx, and by the slender elongate seeds, to list only the more distinct characters. Table 1 compares its calyx characters with closely and distantly related species. It is of interest that the polyploid *G. hirsutum* with $n = 26$ chromosomes more closely approaches the *lobatum* calyx in size and lobing than any other

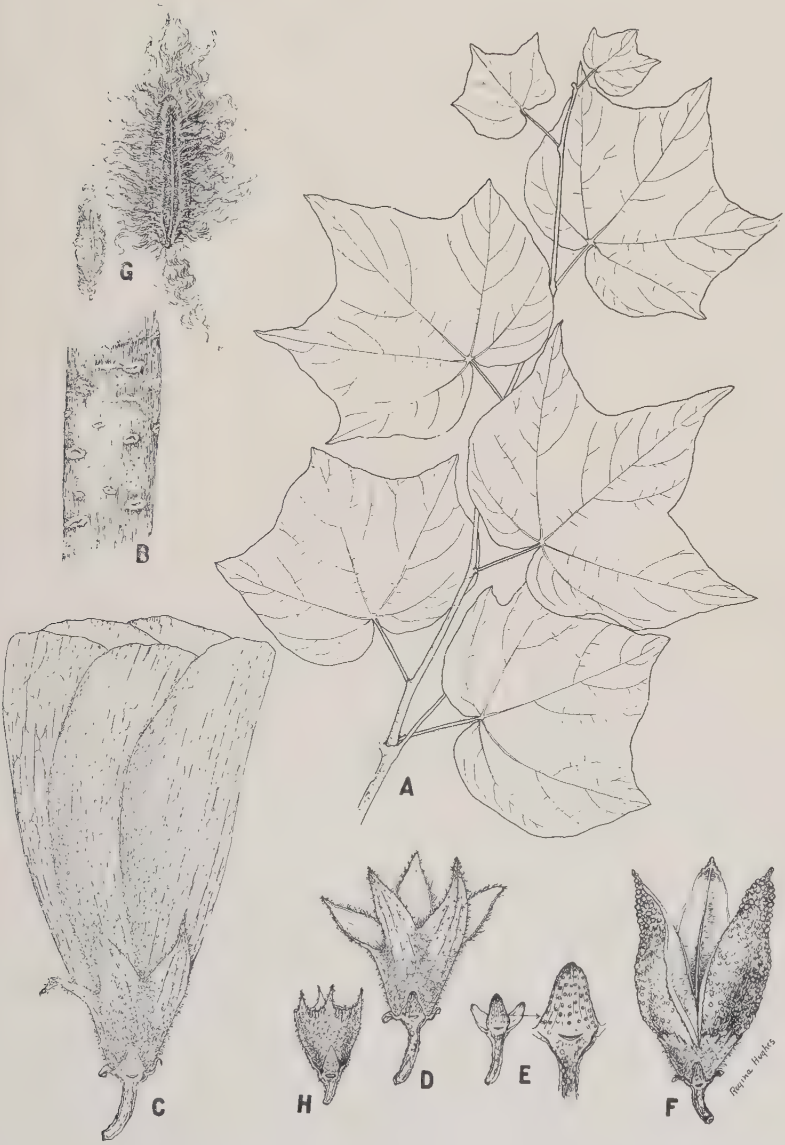

FIG. 1. *Gossypium.* A-G, *Gossypium lobatum:* A, foliage branch, × ⅓. B, section of bark, × 2. C, flower, × 1. D, calyx, × 1. E, involucel, × 1 and × 2. F, capsule, × 1. G, seed, × 1 and × 2. H, *Gossypium aridum,* calyx, × 1.

species. *Gossypium barbadense* also has 26 chromosomes, while the rest of the listed species are considered to have but 13 chromosomes.

Calyces are compared at the anthesis stage as the persistent calyx of *Gossypium* is accrescent and frequently distorted by capsular growth. Measurements were taken from dried herbarium material of several specimens in each case, except for *G. lobatum,* where only one flower was available. *Gossypium lobatum* and *G. aridum* are together distinguished by densely pubescent calyces. The remainder are essentially glabrous, having in a few cases a few trichomes towards the base or distally on the lobes, as in *G. hirsutum*. It appears that all American species can be easily separated by the characters of the involucel and calyx alone.

Table 1. Calyx Features in Some American Species of Gossypium

Species	Tube length	Lobe length	Lobe regularity	Relative pubescence
lobatum	12 mm.	10 mm.	equal	long-pubescent
aridum	5–8	1–3	variable	short-pubescent
armourianum	5	1–2	"	glabrous
harknessii	5–7	1–3	"	"
thurberi	2–3	0–1		"
davidsonii	4–5	0		"
hirsutum	7–10	2–4	subequal	"
barbadense	6	0		"

Gossypium aridum and *G. lobatum*, which have distinct single boles, are the only true tree forms known in the genus. Among American species they are also distinguished by the pink corolla, the elongate androecium (which they share in lesser degree with the Australian section *Sturtiana*), the simple persistent lignified bracteoles, and the slender long-pubescent seeds. *Gossypium lobatum* is more extreme in the latter character. *Gossypium aridum* is Populus-like in habit and is reported by one collector to reach 15 m. in height (*Gentry 5498*), exceeding its associates in the Sinaloa Thorn Forest. *Gossypium lobatum* in the juvenile stage is a low, spreading, broad-leaved shrub, a habit form quite distinct from the slender, monopodial, smaller-leaved, erect tree it becomes in maturity. The writer also observed it a few miles west of Apatzingan, where it was a scattered small-tree component of the semiarid Short-tree Forest over the dark, heavy, argillaceous soil derived from volcanic rocks. Further exploration in the Balsas River basin would doubtless find it present beyond the environs of Apatzingan.

Both these trees are drought deciduous and become leafless during winter. The area of *G. aridum* in central Sinaloa is visited in some years by light winter rains. In such seasons the trees may respond with a flush of leaves, which for lack of moisture remain pauperized. Both trees flower in the late winter and spring during the prolonged dry season while they are generally leafless, releasing their seeds previous to the summer rains beginning in June.

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A SUMMARY OF THE NOMENCLATURE OF DOUGLAS-FIR, PSEUDOTSUGA MENZIESII

VLADIMIR J. KRAJINA

EDITOR'S NOTE. In January, 1956, the Editors of MADROÑO received from Dr. Krajina a manuscript presenting a careful and exhaustive treatment of "The Nomenclatural Problem of Common Douglas-Fir," and substantiating the adoption of the combination PSEUDOTSUGA MENZIESII (Mirb.) Franco, made in 1950. While Dr. Krajina's manuscript was in the hands of the Editorial Board, a series of papers, treating various facets of the same subject and finally reaching the same conclusion as had Dr. Krajina, appeared in "Taxon" [5(1, Febr.): 4–7, 18, 19, 1956; 5(2, Apr.): 38–39, 1956; 5(3, May): 41–43, 43–46, 1956]. Dr. Krajina has consented, therefore, to the deletion of the first two-thirds of his manuscript in which he covered in great detail the history of the problem. The balance of his paper, in slightly revised form, is published herewith.—ED.

There are not many species nomenclaturally so interesting as the common Douglas-fir. A resume of the events involved with the first collections made of this tree sheds light on some of the sources of the confusion concerning the proper name which should be applied to it.

About the discovery of *Abies Douglasii* (Sabine mss.) Thomas Nuttall (1865) wrote as follows: "This species was originally discovered by Mr. Menzies at Nootka Sound, in 1797, during the voyage of Captain Vancouver, and from a specimen without cones or flowers was published a description by Mr. Lambert, under the name of *Pinus taxifolia*, . . ." Sargent (1898), who, in his "Silva of North America," accepted the name *Pseudotsuga mucronata* (Raf.) Sudw., makes the following statement about its early history, "*Pseudotsuga mucronata* was discovered in 1791 on the shores of Nootka Sound by Archibald Menzies, the surgeon of Vancouver in his voyage of discovery; it was first described in the journal of Lewis and Clark. Rediscovered by David Douglas in 1827, it was introduced by him into the gardens of Europe, where it has become one of the best known and most valuable coniferous trees for park plantations." Similarly, Little (1952; 1953) published that Menzies' type-specimen of *Pinus taxifolia* Lamb. was collected at Nootka Sound on Vancouver Island in 1791. However, H. J. Elwes and Augustine Henry (1909) published the following reliable historical data: "The Douglas fir was discovered by Menzies at Nootka Sound in 1797. Seeds were, however, first sent home by Douglas in 1827, from which plants were raised by the Horticultural Society of London and distributed throughout the country."

The first (illegitimate) name, *Pinus taxifolia* Lamb. (1803), was based upon the collection made by Menzies in 1797. Similarly, the second (illegitimate) name, *Abies taxifolia* Poir. (1805), as well as the correct specific basonym, *Abies menziesii* Mirb. (1825), are based upon Lambert's description of the material collected by Menzies.

In 1832 were published two synonyms of *Abies menziesii* Mirb.: the first, *Pinus douglasii* Sabine ex D. Don in Lamb., was based on the original collection by Menzies, complemented by the fruiting material sent to Europe in 1827 by David Douglas; the other synonym is the name published by Rafinesque in the autumn of 1832, *Abies mucronata*. It was based upon the field description by Lewis and Clark (cf. Coues, 1893), the specimens collected by Meriwether Lewis in 1805 and 1806 having been sent to Pursh (1814) who accepted the name *Pinus taxifolia* for them.

Thus, common Douglas-fir was discovered by Archibald Menzies in 1797 at Nootka Sound on Vancouver Island. Another collection was made by Meriwether Lewis on the banks of the Columbia River in 1805–1806. From the same region, cones and other material were collected by David Douglas and sent to Europe in 1827. On these three collections rest the eighteen names that have been applied to this tree.

The complete synonymy [omitting that pertaining to *Pseudotsuga menziesii* var. *glauca* (Beissn.) Franco, which was thoroughly discussed by Little (1953)] follows:

PSEUDOTSUGA MENZIESII (Mirb.) Franco, De Coniferarum duarum nominibus. 4. May, 1950. — Franco, Cedrus libanensis et Pseudotsuga menziesii. Bol. Soc. Brot. (Coimbra), sér. 2, 24: 74. July, 1950. — Franco, Notas sobre a flora lenhosa da Mata do Buçaco. Bol. Soc. Brot. (Coimbra), sér. 2, 25: 206. 1951. — Little, Check list of native and naturalized trees. Agr. Handb. 41: 305. 1953.

Pinus taxifolia Lamb., Descr. Genus Pinus 1: 51, pl. 33. 1803; *nomen illegit*. Non *Pinus taxifolia* Salisb. Prodr. 399. 1796, a synonym of *Abies balsamea* (L. 1753) Mill. 1768.

Abies taxifolia [(Lamb.)] Poir. in Lamarck, Encycl. Méth. Bot. 6: 523. 1805; *nomen illegit*. Non *Abies taxifolia* Mus. ex Du Tour, Nouv. Dict. Hist. Nat. 20: 114. 1803, *pro syn*. (a name not validly published). Non *Abies taxifolia* Desf. Tabl. École Bot. Mus. Hist. Nat. 206. 1804, a synonym of *Abies alba* Mill. 1768. Non *Abies taxifolia* Raf., New Flora N. Am. 1: 38. 1838, a synonym of *Tsuga canadensis* (L. 1763) Carr. 1855.

Abies menziesii Mirb., Paris Mus. Hist. Nat. Mem. 13: 63, 70. 1825 (as "*Menziezii*"). Non *Abies menziesii* (Dougl.) Lindl., Penny Cyclop. 1: 32. 1833, based on *Pinus menziesii* Dougl. ex D. Don in Lamb., Descr. Genus Pinus, ed. 3 (8°), 2: unnumbered page between pp. 144 and 145. 1832, a synonym of *Picea sitchensis* (Bong. 1832) Carr. 1855.

Abies douglasii Hort. ex Loud., Hort. Brit. 388. 1830; *nomen nudum.*

Pinus douglasii Sabine ex D. Don in Lamb., Descr. Genus Pinus, ed. 3 (8°), 2: unnumbered page between pp. 144 and 145, pl. [47]. 1832.

Abies mucronata Raf., Atl. Jour. 1: 120. 1832 (autumn).

Abies douglasii (Sabine ex D. Don in Lamb.) Lindl., Penny Cycl. 1: 32, illus. 1833.

Abies douglasii var. *taxifolia* Loud., Arboretum et Frut. Britannicum 4: 2319, fig. 2231. 1838.

Picea douglasii (Sabine ex D. Don in Lamb.) Link in Linnaea 15: 524. 1841.

Tsuga douglasii (Lindl.) Carr., Traité Gen. Conif. 192. 1855.

Pseudotsuga douglasii (Lindl.) Carr., Traité Gen. Conif., ed. 2, 256. 1867.

Pseudotsuga taxifolia [(Lamb.)] Britton, N.Y. Acad. Sci. Trans. 8: 74. 1889.

Tsuga taxifolia [(Lamb.)] Kuntze, Rev. Gen. Pl. 2: 802. 1891.

Pseudotsuga mucronata (Raf.) Sudw. in Holz., Contr. U. S. Nat. Herb. 3: 266. 1895.

Pseudotsuga taxifolia (Poir.) Britton ex Sudw., U. S. Dept. Agr., Div. Forestry Bull. 14: 46. 1897.

Abietia douglasii (Lindl.) Kent, Veitch's Man. Conif., ed. 2, 476. 1900.

Pseudotsuga vancouverensis Flous, Soc. d'Hist. Nat. Toulouse Bull. 66: 340, pl. 1934; Lab. Forest. Toulouse Trav. tome 1, v. 2, art. 6: 12, pl. 1934.

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Pursh, F. 1814. Flora Americae Septentrionalis. 2: 640.

Sargent, C. S. 1898. The silva of North America. 12: 91.

NOTES AND NEWS

An Extension of Range for Trifolium owyheense Gilkey. In the January issue of the current volume of Madroño this new species of clover was described and cited from Malheur County, Oregon, the only locality known at that time. Since then, an unnamed specimen of clover in the Oregon State College herbarium, collected by Percy Train in 1935, has been found to be this species. The label reads as follows:

> "Trifolium............................ 5/30/35. Alt. 4000′. Belt, Artemisia. Habitat, dry shale hillsides, Steins Mts., Harney County, Oregon, east base, near Follyfarm."

Since Mr. Train's collections of that year were, I believe, widely distributed, it is probable that this species is present in undetermined material in other herbaria.

The Harney County site is approximately 50 miles west of the type locality, with similar topography, sparse vegetation, and blue-gray diatomaceous soil. Further field work is necessary to determine whether the distributional range of the clover coincides with that of the combination of ecological factors thus far known to be associated with it.—Helen M. Gilkey, Oregon State College.

Memorial Endowment Fund. The Executive Council of the California Botanical Society, at its meeting on October 18, 1956, voted to establish a Memorial Endowment Fund to honor the memory of deceased members and friends of the Society. The income from this Memorial Fund is to be used in helping to defray the expenses of the Society, the major portion of which is the publication of Madroño. In perpetually serving the cause of botanical science, the Memorial Fund will thus carry on the work to which these members and friends in whose memory the contributions are made devoted their lives. This Memorial Fund was first conceived in memory of LeRoy Abrams who passed away in August of this year. Since then, Roy Clausen and Thomas H. Kearney have also passed away. It is hoped that members and friends of the California Botanical Society will wish to commemorate in this way those who have done so much to further the science of Botany. Unless a donor stipulates to the contrary, the Society will send a card to the family of the person in whose name a contribution to the Memorial Endowment Fund has been made. Dr. Ira L. Wiggins of Stanford University has been appointed Chairman of the Memorial Endowment Fund Committee.

Some publications of interest follow:

Drawings of British Plants, by Stella Ross-Craig. Part IX. Rosaceae (2). 39 pls. 1956. 8 s./6 d. net. G. Bell and Sons, Ltd. London. With Part IX we have the completion of the third volume of Miss Ross-Craig's monumental work which aims at illustrating all the species of flowering plants growing naturally in the British Isles.

Guide to the Flora of Malta, by Guido B. Lanfranco. 1–66, 300 figs. grouped in 33 pls. 1955. 6 s./6 d. Progress Press Co., Ltd. Malta. A handbook for the layman, of interest to us because of the occurrence in Malta of many species which have become commonly established here as weeds of Mediterranean origin.

Check List of Vascular Plants of San Luis Obispo County, by Robert F. Hoover. 1–53. 1954. California State Polytechnic College, San Luis Obispo, California. A mimeographed species list with some annotations.

Leguminosae of Nevada, Part I — Astragalus and Oyxtropis, by R. C. Barneby. Contributions toward a Flora of Nevada, No. 38. 1–86. 1 fig. 1956. Plant Industry Station, Beltsville, Maryland. Unbound, printed in offset. This is the most recent issue of this series of publications on the flora of Nevada prepared under the supervision of W. Andrew Archer, United States National Arboretum. Originally started in 1940, many parts of the series were published between 1940 and 1942; work was resumed in 1954, and several issues have appeared since then, among which are: *Scrophulariaceae of Nevada, Part I*—Mimulus, by Gabriel Edwin, 1955; *Portulacaceae of Nevada,* by Arthur H. Holmgren, 1955.

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